

Supplementary Online Content

Colla CH, Lewis VA, Kao L-S, O'Malley AJ, Chang C-H, Fisher ES. Association between Medicare accountable care organization implementation and spending among clinically vulnerable beneficiaries. *JAMA Intern Med*. Published online June 20, 2016. doi:10.1001/jamainternmed.2016.2827

eAppendix.

eReferences.

eFigures 1-17. Predicted and Raw Mean Quarterly Spending Per Beneficiary

This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix.

Data: We used 100% Medicare fee-for-service administrative claims data from 2008 through 2013 encompassing all Part A and B charges for our population. Although our models use data beginning in 2009, HCCs measures are assessed over the 12 months preceding the quarter and therefore utilize data from 2008 to 2013. The files used were the denominator file, the inpatient file, MedPAR, the outpatient file, the home health standard analytic file, the skilled nursing standard analytic file, the hospice file, the durable medical equipment file, and the carrier file. We suppressed readmission rates for Maryland due to inconsistencies in the way readmissions were codified in claims data before 2010.¹ Patient demographics are measured on an annual basis, while clinical conditions and outcomes are measured on a quarterly basis. We defined nursing home residents by two or more physician claims for a visit in a nursing home spanning at least 90 days within the 12-month period prior to the quarter.² Each patient was assigned to one of 306 hospital referral regions annually, representing the regional health care market where the beneficiary lives.³

Cohort: We use CMS methodology for Medicare Shared Savings Program attribution to attribute patients to physician groups, including ACOs, for each calendar year 2009-2013 with the following annual exclusions: (1) any Medicare Advantage; (2) less than full Part A and B entitlement the entire year; (3) residence outside the 50 United States or US territories and possessions; and (4) presence of a primary payer other than Medicare. In addition, we limited residency to within the 50 United States or Washington, DC and age to 66 and older. Each beneficiary was classified as either an ACO beneficiary or a non-ACO beneficiary for each calendar year based on care patterns and Medicare Shared Savings Program attribution methodology.⁴

Evaluation and management visits are primary care service provided in an outpatient setting, defined by Healthcare Common Procedure Coding System (HCPCS) codes 99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99304, 99305, 99306, 99307, 99308, 99309, 99310, 99315, 99316, 99318, 99324, 99325, 99326, 99327, 99328, 99334, 99335, 99336, 99337, 99339, 99340, 99341, 99342, 99343, 99344, 99345, 99347, 99348, 99349, 99350, G0402, G0438, and G0439. Beneficiaries were attributed to an ACO when the sum of charges for evaluation and management visits to primary care clinicians at the ACO exceeded the sum of such charges from any other organization in the calendar year. Beneficiaries who did not have a qualifying evaluation and management visit to a primary care clinician were assigned to an ACO or non-ACO physician group if they had at least one qualifying evaluation and management visit to a specialty physician.

The Pioneer ACO program began in January 2012 with 32 organizations, several of whom later switched to the Medicare Shared Savings Program (7) or dropped out of ACO contracts (2) by the end of our study period in 2013. The Medicare Shared Savings Program (MSSP) began in April 2012 (27 ACOs), with more organizations joining in July 2012 (87) and January 2013 (106). We used tax identification numbers (TINs) and National Provider Identifiers (NPIs) from CMS' Shared Savings Program Accountable Care Organizations (ACO) Provider-level Research Identifiable File to identify physicians participating in MSSP ACOs separately for 2012 and 2013.⁵

Although Pioneer attribution methodology differs from MSSP attribution methodology in that it is based on prospective attribution, the attribution process is still based on the same hierarchical approach: the highest payment of evaluation and management claims from primary care providers, followed by specialists. To confirm the accuracy of our Pioneer ACO attribution, we examined several criteria of attribution, all of which our methods fulfill: 1) alignment algorithm: at least 10% of total spending from primary care; 2) Primary care specialist only linked to a single Pioneer ACO; and 3) The average 2-year "alignable" beneficiary count should be at least 15,000, except for rural areas, which should be at least 5,000. The correlation between our attribution and the number of attributed beneficiaries reported by the Medicare program for MSSP ACOs was 0.955.^{6,7}

We identified the clinically vulnerable cohort using Hierarchical Condition Categories (HCCs).⁸ The HCC model includes 70 categories of clinical conditions, assessed over the 12 months preceding the quarter. We identified HCCs for each beneficiary from inpatient (Medicare Provider Analysis and Review, MEDPAR) and physician (Physician/Supplier Part B) claims. Patients were required to have at least one inpatient claim or two outpatient claims (separated by 7 days) with the defined diagnoses to be considered to have the condition. We defined our clinically vulnerable cohort as those individuals aged 66 and up who had at least 3 HCCs during any quarter in our study period. This definition is comparable to previous studies of clinically vulnerable populations, which have defined identifying characteristics such as having multiple medical conditions,⁹⁻¹⁵ mental illness,¹⁶⁻²¹ and frailty or functional impairment.^{12,14,15,22-25} While we

are limited to the 70 categories defined in the HCC methodology, there is substantial overlap among these definitions, and as shown below, our clinically vulnerable criteria identified a high cost, high mortality population.⁸

Identifying ACOs: Because the dataset provided by CMS did not include the Pioneer model ACOs, we identified Pioneer ACO TINs through web search matched with CMS's National Plan & Provider Enumeration System data dissemination file. We were able to obtain several Pioneer ACO TINs directly from the organizations' websites. Physicians were probabilistically matched to the NPI database of licensed health care providers using physicians' names and practice locations as reported on public websites. Matches were accepted if they had a match probability of 99.5% or greater.

Statistical Analysis: For models estimating effects for each ACO wave, we used Wald tests on the coefficients to test the significance of heterogeneity across waves. To address Pioneer dropouts who left the program before the end of our study period, we ran a specification check that includes Pioneer dropouts as a separate "wave" of ACOs, where beneficiaries attributed to these ACOs are reassigned to the control group beginning in January 2013. Excluding these organizations did not statistically change the reported results. To account for possible confounding by practice characteristics, as ACOs are generally larger physician practices than the average physician practice, we estimated a model only including physician practices with at least 5,000 beneficiaries (as required by CMS ACO regulation) in the control group. The results were not significantly different from our main specification.

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Figure 1: Predicted and Raw Mean Quarterly Spending Per Beneficiary









